

***Oldenlandia pinifolia* (Wall. ex G.Don) Kuntze (Rubiaceae), a new addition to the flora of Australia**

John O. Westaway

Summary

J.O.Westaway (2017). *Oldenlandia pinifolia* (Wall. ex G.Don) Kuntze (Rubiaceae), a new addition to the flora of Australia. *Austrobaileya* **10(1): 93–101**. The annual herb *Oldenlandia pinifolia* is newly recorded for Australia with a population in Garig Gunak Barlu National Park on the Cobourg Peninsula of the Northern Territory. The species is described and illustrated based on Australian material, together with assessments of its indigenous and conservation status.

Key Words: Rubiaceae, *Hedyotis*, *Oldenlandia*, *Oldenlandia pinifolia*, *Scleromitron*, Australia flora, Northern Territory flora, taxonomy, new species record

J.O. Westaway, Northern Australia Quarantine Strategy, Australian Department of Agriculture and Water Resources, PO Box 37846 Winnellie, Northern Territory 0821 Australia. Email: john.westaway@agriculture.gov.au

Introduction

The savannah woodlands of northern Australia support a rich flora of annual forbs whose lifecycles are completed during the monsoonal wet season. This annual flora is frequently dominated by the monocot families Poaceae and Cyperaceae but also includes many dicots derived from a diverse array of plant families. Rubiaceae may be better known for its rich tropical forest flora of perennial trees and shrubs but is also well represented by an annual herbaceous flora. For example the genus *Spermacoce* L. has 57 species in the Northern Territory (NT Herbarium 2015) and Halford's (1992) review of *Oldenlandia* and related Rubiaceae listed 20 *Oldenlandia* L. species and four *Hedyotis* L. distributed across the northern half of Australia. There are presently 14 *Oldenlandia* species recognised in the NT including three endemic species (NT Herbarium 2015).

Material of a Rubiaceous herb was collected during a plant health survey conducted by the Northern Australia Quarantine Strategy (NAQS) of the Australian Department of Agriculture and Water Resources in June 2015 at Garig Gunak Barlu National Park (GGBNP) on the Cobourg

Peninsula. Such surveys inspect host plants at settled locations across northern Australia as part of a surveillance program aimed at early detection of plant pest and disease incursions. The specimen (*Westaway 4819*) was later identified by Ian Cowie at the Northern Territory Herbarium (DNA) to be *Oldenlandia pinifolia* (Wall. ex G.Don) Kuntze using the description and key in the *Flora of China* (Chen & Taylor 2017) where it is referred to as *Hedyotis pinifolia* Wall. ex G.Don. Review of the unidentified *Oldenlandia* specimens held at the NT Herbarium (DNA) revealed a single 1987 collection (*Clarke 1059*) from Smith Point, Cobourg Peninsula, originally lodged as *Borreria* sp., that was also determined to be *O. pinifolia*.

This paper provides a description and illustrations of *Oldenlandia pinifolia* and discusses its occurrence and putative indigenous status in Australia.

Materials and methods

The description below is based on the measurements of dried and fresh material collected at Cobourg Peninsula. Photographs of fresh floral parts were taken under microscopy. Accessions of undetermined *Hedyotis* and *Oldenlandia* material lodged at DNA were subsequently examined. The Vegetation Site Database of floristic surveys

in the NT maintained by NT Department of Land Resource Management was also reviewed for *Oldenlandia* records from Cobourg Peninsula. Photos are by the author except where otherwise credited.

Taxonomy

Oldenlandia pinifolia (Wall. ex G.Don) Kuntze, *Revis. Gen. Pl.* 1: 292 (1891); *Hedyotis pinifolia* Wall. ex G.Don, *Gen. Hist.* 3: 526 (1834); *Scleromitrium pinifolium* (Wall. ex G.Don) R.J.Wang, *J. Trop. Subtrop. Bot.* 22: 440 (2014). **Type:** Myanmar. Amherst, in 1827, *N. Wallich Cat. no. 850* (holo: K-W [K 001110062]).

Annual **herb** to 20 cm tall with stout fibrous root mass. **Stems** wiry, dark reddish and hispid, sub-terete to 4-angled by way of striate longitudinal ridges. **Stipules** adnate to leaf bases, c. 0.5 mm long, 1–1.5 mm wide; base truncate; with 4 or 5 bristles 2–3 mm long. **Leaves** subsessile, opposite, linear, 6–20 mm long, 1–2 mm wide, punctate, sparsely hispid to scabrid adaxially, plano-convex in section with prominent midrib; apex acute; margins slightly thickened, revolute on drying. **Inflorescence** axillary or in short axillary fascicles, subtended by setose bracts to 2 mm long and sometimes also 1 or 2 reduced leaves. **Flowers** 1 to 10, subsessile or with pedicel to 1 mm long. **Hypanthium** obconical, ridged, hispid and swollen in fruit. **Calyx** 2–3 mm long, triangular with midvein conspicuous; lobes 4, 0.6–1.2 mm, < 1/2 calyx length, glabrescent with hispid margins. **Corolla** white to pink, glabrous externally; tube 1–2 mm long; lobes 4, 1–2 mm long, oblong, incurved at acute apex. **Stamens** 4, exserted; filaments attached at corolla sinus; anthers oblong c. 0.5 mm. **Pistil** c. 1 mm, exserted; stigma bifid. **Capsule** ovoid, dehiscing apically, 1.6–3 × 1–2 mm enclosed in remnant hypanthium. **Seeds** numerous, polyhedral, c. 0.3 × 0.2 mm with brown reticulate testa. **Figs. 1–10.**

Additional specimens examined: Northern Territory. DARWIN & GULF DISTRICT: Smith Point Camp Site 2, Cobourg Peninsula, Jun 2015, *Westaway 4819* (CANB, DNA); Feb 2017, *Westaway 5206* (DNA); 2.3 km N Black Point & 1.67 km SE Smith Point, Feb 2017, *Westaway 5211* (BRI, DNA); Cobourg Peninsula, May 1987, *Clarke 1059* (DNA).

Distribution and habitat: The native geographic range of *Oldenlandia pinifolia* is south-east Asia including southern China, Nepal, southern India, Myanmar, Thailand, Vietnam and Malaysia (Chen *et al.* 2010; Chen & Taylor 2017; The Herbarium Catalogue 2017) and Brunei, Cambodia and Laos (National Herbarium of the Netherlands database 2017). Chen & Taylor (2017) record this species from six Chinese provinces and Neupane *et al.* (2015) cite collections from China, Thailand and Indonesia. *O. pinifolia* is recorded for the island of Singapore (Chong *et al.* 2009 as *H. pinifolia*) and also from sandy areas of two provinces in Java (Backer & Bakhuizen van den Brink 1965 as *H. pinifolia*). The nearest known location to Australia where *O. pinifolia* has been recorded is in Manggarai, Flores, Nusa Tenggara, Indonesia, based on a 1981 specimen (L2916754) held at Leiden (National Herbarium of the Netherlands database 2017).

In Australia the species has been found only on the Cobourg Peninsula at the northern most part of the Northern Territory. On Cobourg Peninsula, the species has only been recorded from Smith Point (**Map 1**), where it occurs in intact native coastal dune vegetation comprising a coastal sandplain grassland with *Enneapogon pallidus* (R.Br.) P.Beauv., *Sida pusilla* Cav., *Tephrosia remotiflora* F.Muell. ex Benth., *Ptilotus conicus* R.Br., *Zornia* sp. and *Notoleptopus decaisnei* (Benth.) Voronts. & Petra Hoffm. However, targeted survey elsewhere has not been undertaken and given that there exists substantial areas of similar coastal habitats within the extensive GGBNP, the occurrence of further populations is likely and *O. pinifolia* is probably more widespread than current records indicate.

Phenology: Flowering and fruiting of this annual herb occurs during the northern monsoon season between December and April. Plants have been observed flowering at a young (small size) stage in February and in fruit in June after plants have dried.

Typification: Don (1838) cited a single element in the Wallich herbarium when naming *Hedyotis pinifolia*; this is regarded as the holotype.



Fig. 1. Coastal dune swale habitat of *Oldenlandia pinifolia* at Cobourg Peninsula

Notes: From their phylogeny of the *Hedyotis*/*Oldenlandia* complex, Guo *et al.* (2013) proposed the resurrection of the genus *Scleromitron* to accommodate a clade of species previously recognised under *Oldenlandia*. *Scleromitron* Wight & Arn. was first described in 1834 as a section of *Hedyotis* and subsequently elevated to generic rank by Meisner (1838).

Guo *et al.* (2013) recognized the generic name *Scleromitron* for a group primarily based on the presence of homostylous flowers with exserted stamens and styles. They note that *Scleromitron* resembles *Oldenlandia* morphologically in terms of plant habit and capsule and stipule characters, but can be distinguished by their inflorescence and flower traits. *Oldenlandia s. str.* usually has terminal or axillary panicles with obvious or very short peduncles and 2–5-pedicelled flowers in each peduncle. In contrast, *Scleromitron* has either

axillary clusters of 2–5-sessile flowers or a single flower with a long and slim pedicel that is borne terminally or axillary (Guo *et al.* 2013). Neupane *et al.* (2015) also constructed a phylogenetic tree based on combined nuclear and plastid molecular data which again placed *Oldenlandia pinifolia* in part of a clade termed *Scleromitron*, characterised by homostylous flowers with exserted stamens and styles.

Scleromitron is distributed in Asia, Africa, and Australia, and *Oldenlandia s. str.* is mainly limited to Africa, except for the pantropical species, *O. corymbosa* L. (Guo *et al.* 2013). The genus *Scleromitron* is not presently recognised in Australia (APC 2017).

Cobourg Peninsula has a history of early settlement and a plausible historic pathway for introduction of foreign plants via seed was in association with the importation of banteng cattle (*Bos javanicus*) from Indonesia in 1849. *Oldenlandia pinifolia* was collected in 2015 at



Fig. 2. *Oldenlandia pinifolia*. Habit of flowering plants.



Fig. 3. *Oldenlandia pinifolia*. Stem node with stipule (Westaway 5211, DNA). Photo: Ying Y. Luo.



Fig. 4. *Oldenlandia pinifolia*. Flowering stem (Westaway 5211, DNA). Photo: Ying Y. Luo.



Fig. 5. *Oldenlandia pinifolia*. Lateral view of flower (Westaway 5211, DNA). Photo: Ying Y. Luo.



Fig. 6. *Oldenlandia pinifolia*. Dissected flower laid out to demonstrate aestivation and stamens (Westaway 5211, DNA). Photo: Ying Y. Luo.



Fig. 7. *Oldenlandia pinifolia*. Corolla (Westaway 5211, DNA). Photo: Ying Y. Luo.

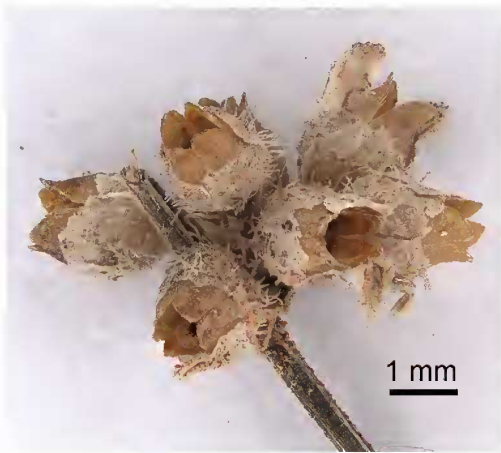


Fig. 8. *Oldenlandia pinifolia*. Infructescence with fruiting capsules (Westaway 4819, DNA). Photo: Ying Y. Luo.

a camping site at GGBNP where small annual plants remained alive during the dry season due to runoff received from a shower amenity block. Dried plants were also seen at the nearby airstrip. As *O. pinifolia* was associated with the ruderal weeds *Phyllanthus amarus* K.Schum. & Thonn. and *Euphorbia hirta* L. at the campground and in disturbed soil at the airstrip it was thought that the species was an introduction.

However, on a subsequent inspection during the 2016–17 wet season, *O. pinifolia* was found within intact native coastal dune vegetation (**Fig. 1**). Abundant *O. pinifolia* seedlings were present there in February in well-drained sandy loam of the hind dune swale (**Fig. 10**).



Fig. 9. *Oldenlandia pinifolia*. Seeds (Westaway 4819, DNA). Photo: Ying Y. Luo.

The 1987 specimen (Clarke 1059) describes the habitat as a tall eucalypt woodland with species of *Acacia*, *Planchonia* and *Flueggea* and lacks reference to disturbance or associated exotic species, suggesting that the collection was also made from intact native vegetation.

Bean (2007) put forward criteria and a key to determine the origin status of non-endemic plants in Australia. Despite a lack of historical evidence such as early herbarium records (probably overlooked as inconspicuous annual) and equivocal ecological evidence, using the method of Bean (2007), *O. pinifolia* would key to indigenous based on the following criteria: non-adhesive terrestrial plant; indigenous in adjacent areas such as Java and related species indigenous in Australia. This occurrence thus represents the southern extent of the species' natural geographic range and represents a new record for Australia.

Conservation status: *Oldenlandia pinifolia* is regarded as Vulnerable in Singapore (Chong *et al.* 2009, as *Hedyotis pinifolia*) and its conservation status in other countries is unknown. Despite lack of information on threats that may exist to this species in

overseas countries, based on IUCN (2012) criteria *O. pinifolia* would likely be classified internationally as of Least Concern due to the species' large extent of occurrence and (presumed) area of occupancy, and the species apparent fecundity and abundance.

Within Australia, *O. pinifolia* is currently only known from Smith Point on Cobourg Peninsula, Northern Territory. As indicated above the species may occur at additional sites around the extensive coastline of Cobourg Peninsula where apparently suitable habitat would appear plentiful. However GGBNP has been moderately well surveyed for such a large and remote part of the NT, with 172 full-floristic biodiversity survey plots undertaken since 2005 (by Flora & Fauna Branch of the NT Department of Land Resource Management) which equates to a survey density of approximately 8.2 plots per 100 km². The majority of these sites were surveyed in an appropriate season for annual plants but of the 172 flora plots an unidentified *Oldenlandia* was recorded at only a single site (Cobourg_Col8) taken at Smith Point in April 2006. This record may represent *O. pinifolia*, as the only other *Oldenlandia* species known from the region are *O. galioides* and the introduced *O. corymbosa*,



Fig. 10. High density of *Oldenlandia pinifolia* seedlings in sandy soil of coastal plain, Cobourg Peninsula.

both readily recognised species. This scarcity of *Oldenlandia* records on Cobourg Peninsula suggests that *O. pinifolia* may indeed be restricted in extent.

Oldenlandia pinifolia was locally abundant at Smith Point in 2016–17 with many thousands of individuals (**Fig. 10**). It appears that the species is capable of producing abundant seed and young seedlings (at least in a good year) but presumably mass thinning occurs as the soil profile dries and only a small percentage of seedlings are recruited annually into the population.

Given its local abundance in Australia and its widespread distribution overseas *Oldenlandia pinifolia* is not likely to be at risk of extinction globally. As GGBNP is a conservation reserve there are no identifiable threatening processes that are likely to impact detrimentally on this species. However, due

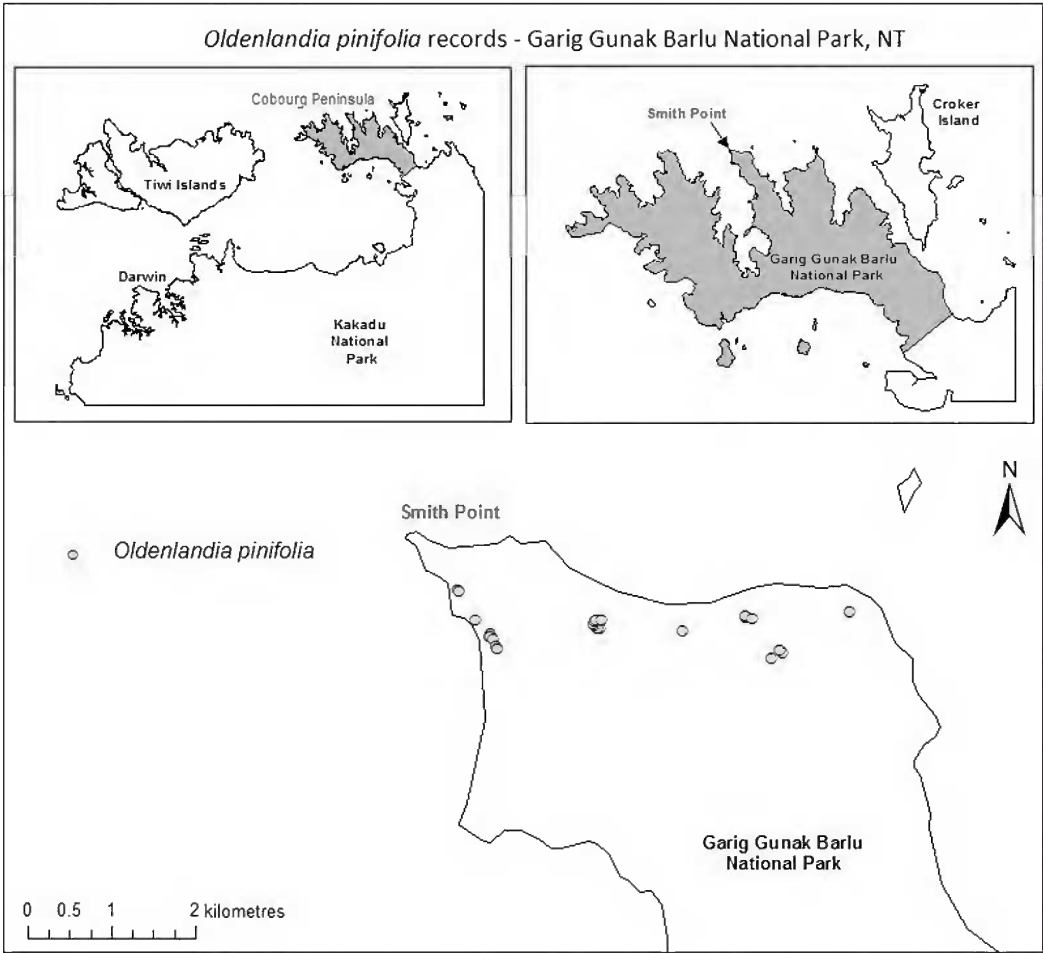
to its currently limited known distribution in Australia it would be classified as ‘Data Deficient’ under the *Territory Parks and Wildlife Conservation Act 2000* (Northern Territory Government 2017).

Acknowledgements:

Ian Cowie, Chief Botanist, NT Herbarium (DNA) is acknowledged for identifying my *Oldenlandia* specimens that this article is based on. Ying Luo is thanked for the photomicroscopy and Barbara Waterhouse for comment on the draft. I am grateful to the input from the anonymous referee. The Traditional Owners of Garig Gunak Barlu National Park are also acknowledged.

References

- APC (2017). *Australian Plant Census*, IBIS database, Centre for Australian National Biodiversity Research, Council of Heads of Australasian Herbaria. <http://www.chah.gov.au/apc/index>, accessed 22 March 2017.
- BACKER, C.A. & BAKHUIZEN VAN DEN BRINK, R.C. (1965). *Flora of Java* 2: 285. N.V.P. Noordhoff: Groningen.
- BEAN, A.R. (2007). A new system for determining which plant species are indigenous in Australia. *Australian Systematic Botany* 20: 1–43.
- CHEN, S.-H., SU, J.-Y. & WU, M.-J. (2010). *Hedyotis pinifolia* Wall. ex G. Don (Rubiaceae), a new record to the flora of Taiwan. *Taiwania* 55: 86–89.
- CHEN, T. & TAYLOR, C. (2017). *Hedyotis* L. In *Flora of China* 19: 147–174. Science Press/Missouri Botanical Garden Press: Beijing/St Louis. http://www.efloras.org/florataxon.aspx?flora_id=2&taxon_id=200022111, accessed 22 March 2017.
- CHONG, K.Y., TAN, H.T.W. & CORLETT, R.T. (2009). *A Checklist of the Total Vascular Plant Flora of Singapore: Native, Naturalised and Cultivated Species*. Raffles Museum of Biodiversity Research, National University of Singapore: Singapore.
- DON, G. (1838). *A general history of the Dichlamydeous plants*. Rivington: London.
- GUO, X., WANG, R.J., SIMMONS, M.P., BUT, P.P.H. & YU, J. (2013). Phylogeny of the Asian *Hedyotis–Oldenlandia* complex (Spermacoceae, Rubiaceae): Evidence for high levels of polyphyly and the parallel evolution of diplophragmous capsules. *Molecular Phylogeny & Evolution* 67: 110–122.
- HALFORD, D.A. (1992). Review of the genus *Oldenlandia* L. (Rubiaceae) and related genera in Australia. *Austrobaileya* 3: 683–722.
- IPNI (2017). The International Plant Names Index. <http://www.ipni.org>, accessed 24 April 2017.
- IUCN (2012). *International Union for the Conservation of Nature. IUCN Red List Categories and Criteria*. Version 3.1, 2nd ed. <http://portals.iucn.org/library/efiles/documents/RL-2001-001-2nd.pdf>, accessed 10 March 2017.
- MEISNER, C.D.F. (1838). *Scleromitron. Plantarum Vascularium Genera* 5: 160. Weidmannia: Lipsiae.
- NATIONAL HERBARIUM OF THE NETHERLANDS DATABASE (2017). <http://herbarium.naturalis.nl/nhn/explore>, accessed 22 March 2017.
- NEUPANE, S., DESSEIN, S., WIKSTRÖM, N., LEWIS, P.O., LONG, C., BREMER, B. & MOTLEY T.J. (2015). The *Hedyotis–Oldenlandia* complex (Rubiaceae: Spermacoceae) in Asia and the Pacific: Phylogeny revisited with new generic delimitations. *Taxon* 64: 299–322.
- NORTHERN TERRITORY GOVERNMENT (2017). Classification of wildlife. <http://nt.gov.au/environment/animals/classification-of-wildlife>, accessed 22 March 2017.
- NORTHERN TERRITORY HERBARIUM (2015). *FloraNT Northern Territory Flora Online*, Department of Land Resource Management, <http://eflora.nt.gov.au>, accessed 22 March 2017.
- THE HERBARIUM CATALOGUE (2017). Royal Botanic Gardens, Kew. <http://www.kew.org/herbcat>, accessed 22 March 2017.
- THE PLANT LIST (2013). Version 1.1. <http://www.theplantlist.org/>, accessed 22 March 2017.



Map 1. Distribution of *Oldenlandia pinifolia* in Australia.